

What is claimed is:

1. A process for preparation of a phosphor represented by the following formula (I):

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in which A is at least one element selected from the group consisting of Ce, Pr, Nd, Sm, Eu, Tb, Dy, Ho, Er, Tm, and Yb; L is at one element selected from the group consisting of Zr, Nb, Hf, Ta, Sn, Sm, Tm and Yb, provided that L differs from A; x, y and z are numbers satisfying the conditions of $0 \leq x$, $0 \leq y$, $0 \leq z$ and $1.5 \leq x+y+z \leq 2.2$; p is a number to neutralize the phosphor in regard to electric charge thereof, a is a number satisfying the condition of $2 \times 10^{-5} < a < 6 \times 10^{-2}$, and b is a number satisfying the condition of $0 \leq b < 1 \times 10^{-2}$;

15 which comprises the steps of:

(1) heating a rare earth carboxylate represented by the formula (II):

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in which M is at least one rare earth element selected from the group consisting of Lu, Y and Gd; R^1 is an aliphatic hydrocarbon group having 1 to 4 carbon atoms which has a substituent or no substituent; and m is a number satisfying the condition of $0 \leq m \leq 4$;

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with an alkoxyalcohol represented by the formula (III) to obtain a solution:



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in which R^2 is an aliphatic hydrocarbon group having 1 to 4 carbon atoms or a substituted aliphatic hydrocarbon group having 3 to 6 carbon atoms; and n is 2 or 3;

(2) adding to the obtained solution a silicon
10 alkoxide represented by the formula (IV):



in which R^3 is an aliphatic hydrocarbon group having 1 to
15 4 carbon atoms

and a compound containing the element represented by A, and if required a compound containing the element represented by L, to prepare a mixture; and

(3) subjecting the prepared mixture to thermal de-
20 composition.

2. The process of claim 1, wherein R^1 in the formula (II) is methyl.

25 3. The process of claim 1, wherein the alkoxyalcohol represented by the formula (III) is at least one compound selected from the group consisting of 2-methoxyethanol, 2-ethoxyethanol, 1-methoxy-2-propanol, 1-ethoxy-2-propanol, and 3-ethoxy-1-propanol.

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4. The process of claim 1, wherein R^3 in the formula (IV) is ethyl.

5. The process of claim 1, comprising the steps of
- 5 (1) heating an acetate of at least one element selected from the group consisting of Lu, Y and Gd with at least one alcohol selected from the group consisting of 2-methoxyethanol and 2-ethoxyethanol, to obtain a solution;
- 10 (2) adding to the obtained solution tetraethoxysilane and a compound containing the element represented by A, and if required, a compound the element represented by L, to prepare a mixture;
- and
- 15 (3) subjecting the prepared mixture to thermal decomposition.

6. The process of claim 1, wherein the phosphor is represented by the formula (V):

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in which A' is at least one element selected from the group consisting of Ce and Tb; L' is at least one element

25 selected from the group consisting of Zr, Hf, Sm and Yb, provided that L' differs from A'; x is a number satisfying the condition of $1.5 \leq x \leq 2.2$; p is a number to neutralize the phosphor in regard to electric charge thereof, and a is a number satisfying the condition of

$2 \times 10^{-5} < a < 6 \times 10^{-2}$, and b is a number satisfying the condition of $0 \leq b < 1 \times 10^{-2}$.

7. A process for preparation of a phosphor represented by the formula (I):



in which A is at least one element selected from the group consisting of Ce, Pr, Nd, Sm, Eu, Tb, Dy, Ho, Er, Tm, and Yb; L is at one element selected from the group consisting of Zr, Nb, Hf, Ta, Sn, Sm, Tm and Yb, provided that L differs from A; x, y and z are numbers satisfying the conditions of $0 \leq x$, $0 \leq y$, $0 \leq z$ and $1.5 \leq x+y+z \leq 2.2$; p is a number to neutralize the phosphor in regard to electric charge thereof, a is a number satisfying the condition of $2 \times 10^{-5} < a < 6 \times 10^{-2}$, and b is a number satisfying the condition of $0 \leq b < 1 \times 10^{-2}$;

which comprises the steps of:

(1) heating a rare earth carboxylate represented by the formula (II):



in which M is at least one rare earth element selected from the group consisting of Lu, Y and Gd; R^1 is an aliphatic hydrocarbon group having 1 to 4 carbon atoms which has a substituent or no substituent; and m is a number satisfying the condition of $0 \leq m \leq 4$;

with an alkoxyalcohol represented by the formula (III), to obtain a solution:



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in which R^2 is an aliphatic hydrocarbon group having 1 to 4 carbon atoms or a substituted aliphatic hydrocarbon group having 3 to 6 carbon atoms; and n is 2 or 3;

(2) adding to the obtained solution a silicon
10 alkoxide represented by the formula (IV):



in which R^3 is an aliphatic hydrocarbon group having 1 to
15 4 carbon atoms

and a compound containing the element represented by A, and if required a compound containing the element represented by L, to prepare a mixture;

(3) bringing water into contact with the prepared
20 mixture to give a gel; and

(4) subjecting the given gel to thermal decomposition.

8. The process of claim 7, wherein R^1 in the formula (II) is methyl.
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9. The process of claim 7, wherein the alkoxyalcohol represented by the formula (III) is at least one compound selected from the group consisting of 2-methoxy-

ethanol, 2-ethoxyethanol, 1-methoxy-2-propanol, 1-ethoxy-2-propanol and 3-ethoxy-1-propanol.

10. The process of claim 7, wherein R^3 in the formula (IV) is ethyl.

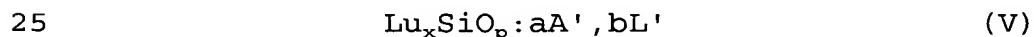
11. The process of claim 7, comprising the steps of
(1) heating an acetate of at least one element selected from the group consisting of Lu, Y, and Gd with at least one alcohol selected from the group consisting of 2-methoxyethanol and 2-ethoxyethanol, to obtain a solution;

(2) adding to the obtained solution tetraethoxysilane and a compound containing the element represented by A, and if required a compound containing the element represented by L, to prepare a mixture; and

(3) bringing water into contact with the prepared mixture, to give a gel; and

(4) subjecting the given gel to thermal decomposition.

12. The process of claim 7, wherein the phosphor is represented by the following formula (V):



in which A' is at least one element selected from the group consisting of Ce and Tb; L' is at least one element selected from the group consisting of Zr, Hf, Sm and Yb, provided that L' differs from A'; x is a number satisfy-

ing the condition of $1.5 \leq x \leq 2.2$; p is a number to neutralize the phosphor in regard to electric charge thereof, and a is a number satisfying the condition of $2 \times 10^{-5} < a < 6 \times 10^{-2}$, and b is a number satisfying the condition of $0 \leq b < 1 \times 10^{-2}$.